Comparison of User Traffic Characteristics on Mobile-Access versus Fixed-Access Networks

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Abstract. We compare Web traffic characteristics of mobile- versus fixed-access end-hosts, where herein the term “mobile” refers to access via cell towers, using for example the 3G/UMTS standard, and the term “fixed” includes Wi-Fi access. It is well-known that connection speeds are in general slower over mobile-access networks, and also that often there is higher packet loss. We were curious whether this leads mobile-access users to have smaller connections. We examined the bytes-per-connection and packet loss based on packet retransmissions from a sampling of logs from servers of Akamai Technologies. We obtained 149 million connections, across 51 countries. The mean bytes-per-connection was typically larger for fixed-access: for two-thirds of the countries, it was at least one-third larger. Regarding distributions, we found that the difference between the bytes-per-connection for mobile- versus fixed-access was statistically significant for each of the countries, and likewise for packet loss. However, the difference is typically small. For some countries, mobile-access had the larger connections. As expected, mobile-access often had higher packet loss than fixed-access, but the reverse pertained for some countries. Typically packet loss increased during the busy period of the day, when mobile-access had a larger increase.

1 Introduction

Mobile broadband has become a significant factor in the Internet communications market, and it continues to grow: Cisco \cite{cisco} forecast that global mobile IP data traffic will double every year through 2014. Informa \cite{informa} estimated that there would be globally 670 million mobile broadband subscribers in 2011.

We are interested in comparing Web traffic characteristics of mobile- versus fixed-access end-hosts, where herein the term “mobile” refers to access via cell towers, using for example the 3G/UMTS standard, and the term “fixed” includes Wi-Fi access. Whereas prior work has compared the applications used by mobile- and fixed-access devices \cite{10}, here we are interested in the network level, and comparing the size of connections (i.e., number of bytes per connection) for mobile versus fixed devices that are accessing the Web.\footnote{An extended version of this paper is available as a technical report \cite{6}.}
It is well-known that connection speeds are in general slower over mobile-access networks [2]. Also, and as reported herein, often, though not always, there is higher packet loss with mobile-access, see §4.2. We are curious whether this leads users to have smaller connections, or would they persevere, so to speak, through the more adverse network conditions.

From a sampling of logs from July 2010 from servers of Akamai Technologies, we examine the number of bytes-per-connection, and packet loss based on packet retransmissions. The data for this study were collected prior to the deployment of 4G/LTE, and thus form a baseline for comparison for when 4G/LTE is broadly in use.

The contributions of this study are:

1. The first reported comparison of mobile- versus fixed-access connection-size and packet-loss
2. The comparison of the daily variation in bytes-per-connection and packet loss, for mobile- and fixed-access
3. Results spanning 51 countries

This paper is structured as follows: §2 reviews the related work. §3 describes our data set. §4 contains our results. §5 summarizes and discusses our results.

2 Related Work

Regarding side-by-side comparison of mobile- and fixed-access traffic, Akamai’s [2] quarterly “State of Internet” reports connection speeds for both fixed- and mobile-access. Also, Sandvine [10] reported traffic profiles for both fixed- and mobile-access. Complementing these two studies, the present work also makes such a comparison, though in contrast to the prior work, we examine different attributes: the number of bytes per connection and packet loss. Using a data set from the Akamai content distribution servers, our study is global in scope and presents results for over 50 different countries.

In addition to the two previous side-by-side fixed- and mobile-access traffic comparisons at the network level, at least two studies have compared fixed- and mobile-access traffic at the application level: Hossfeld et al. [8] compared the performance of a peer-to-peer file sharing application in both fixed- and mobile-access networks, whereas Svoboda [11] compared the session lengths of online gamers in fixed- and mobile-access networks. Furthermore, Kalden & Ekström [9] compared (non-side-by-side) the results from their analysis of GPRS mobile-access traffic to studies of fixed-access traffic by other researchers.

3 Data Set and Methodology

We used data from log files of Akamai Technologies that contained information that enabled a comparison of mobile- and fixed-access traffic on a per country basis. The data consisted of a global sub-sampling of TCP connections between